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Original Research Article

Knowledge, attitudes and practices concerning diabetes self-management education among medical students: a cross-sectional study

Pratyush Jha*, Soham Khan

Department of Community Medicine, DY Patil Hospital and Medical College, Navi Mumbai, Maharashtra, India

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***Correspondence:**
Dr. Pratyush Jha,
E-mail: jhapratyush90@gmail.com

ABSTRACT

Background: Diabetes self-management education (DSME) is crucial for optimal diabetes care, yet medical students' preparedness to provide such education remains poorly understood. This study has been done to assess knowledge, attitudes, and practices concerning diabetes self-management education among senior medical students and identify factors associated with competency levels.
Methods: This cross-sectional study enrolled 200 medical students (4th and 5th year) aged 22-25 years from Tertiary Care Hospital and Medical College of Maharashtra. A validated questionnaire assessed knowledge, attitudes, and practices regarding DSME across multiple domains. Scores were categorized as poor or good based on predetermined cutoffs. Associations between demographic factors and KAP scores were analyzed.
Results: Mean knowledge score was 6.51±1.39, attitude score was 3.17±0.83, and practice score was 4.03±0.89. Knowledge was classified as good in 74% of students, attitudes as good in 91%, and practices as good in 72%. Males comprised 55.5% of participants. Fourth-year students (51.5%) showed slightly better knowledge scores compared to fifth-year students (48.5%). Age distribution showed 37.5% were 23 years old. Significant associations were found between academic year and attitude scores, with fourth-year students demonstrating better attitudes toward DSME ($p<0.05$).
Conclusions: While most medical students demonstrated positive attitudes toward diabetes education, knowledge and practice domains showed concerning gaps. The study reveals a need for enhanced diabetes education curricula that bridge the gap between theoretical knowledge and practical application. Structured DSME training programs should be integrated into medical education to better prepare future physicians for comprehensive diabetes care.

Keywords: Medical students, Diabetes self-management education, Knowledge attitudes practices, Medical education, Diabetes care

INTRODUCTION

Diabetes mellitus represents one of the most significant public health challenges of the 21st century, with global prevalence continuing to rise at an alarming rate.[1] The International Diabetes Federation estimates that the 537 million adults worldwide currently live with the diabetes number projected to reach the 783 million by 2045.[2] This epidemic places unprecedented demands on healthcare systems and underscores the critical importance of effective diabetes management strategies. Central to optimal diabetes care is diabetes self-management education and support (DSMES), which empowers patients with the knowledge, skills, and confidence necessary to effectively manage their condition.[3] The American Diabetes Association recognizes DSME as a

standard of care, citing substantial evidence for its effectiveness in improving glycemic control, reducing complications, and enhancing quality of life.[4] However, the success of DSME programs depends heavily on the competency of healthcare providers delivering this education.

Medical students represent the next generation of healthcare providers who will be responsible for diabetes care and patient education. Their knowledge, attitudes, and practices (KAP) regarding diabetes self-management education during their training period can significantly influence their future effectiveness as clinicians and health educators.[5,6] Research has demonstrated that healthcare providers' personal beliefs, knowledge levels, and confidence in their educational abilities directly impact the quality and effectiveness of patient education they provide.[7]

The transition from medical student to practicing physician involves developing not only clinical knowledge but also educational and communication skills essential for patient care.[8] For diabetes management, this includes understanding the multidisciplinary nature of care, the importance of lifestyle modifications, and the complexity of self-management behaviors that patients must adopt.[9]

The KAP framework provides a comprehensive approach to understanding competency development in health education. Knowledge encompasses the theoretical understanding of diabetes pathophysiology, management principles, and educational strategies. Attitudes reflect the emotional and evaluative responses to diabetes care and patient education, including beliefs about the importance of DSME and confidence in one's ability to provide effective education. Practices represent the behavioral components, including actual engagement in educational activities and application of knowledge in clinical settings.[10]

Previous studies have revealed significant gaps in healthcare providers' diabetes knowledge and educational competencies.[11,12] These deficits can lead to suboptimal patient education, missed opportunities for behavioral intervention, and ultimately poorer patient outcomes. Identifying and addressing these gaps during medical education represents a crucial opportunity for intervention.

Study rationale and objectives

Despite the recognized importance of DSME and the critical role of medical students as future educators, limited research has systematically evaluated medical students' preparedness to provide diabetes education. Most existing studies focus on general diabetes knowledge rather than specifically assessing competencies related to patient education and self-management support.

This study addresses this gap by comprehensively evaluating the knowledge, attitudes, and practices of senior medical students regarding diabetes self-management education. The findings will inform curriculum development, identify areas requiring enhanced instruction, and contribute to the broader understanding of how to better prepare medical students for their role as diabetes educators.

Primary objective

Primary objective of the study was to assess the knowledge, attitudes, and practices concerning diabetes self-management education among 4th and 5th year medical students.

Secondary objectives

Secondary objectives were to evaluate the distribution of KAP scores across demographic variables; to identify factors associated with higher competency levels; to determine the relationship between knowledge and practice domains; to assess medical students' confidence in providing diabetes education.

METHODS

Study design and setting

This cross-sectional observational study was conducted at Tertiary Care Hospital and Medical College, Navi Mumbai, Maharashtra, India, from June 2023 to May 2025. The institution is a private medical college that serves a diverse student population and maintains affiliations with multiple clinical training hospitals in the Mumbai metropolitan region.

Study population and sampling

The study targeted senior medical students (4th and 5th year) who had completed their pathophysiology and clinical medicine coursework and had exposure to diabetes care in clinical settings. These students represent the cohort most likely to encounter diabetes patients and provide educational support during their clinical rotations.

Inclusion criteria

Students enrolled in 4th or 5th year MBBS program; age between 22-25 years; completed at least one clinical rotation involving internal medicine or endocrinology; voluntary participation with informed consent were included.

Exclusion criteria

Students with incomplete clinical training; those currently on extended leave or absence from clinical rotations; students with personal or immediate family history of

diabetes (to avoid potential bias in responses) were excluded.

A total of 200 students were recruited through systematic sampling from class rosters, ensuring proportional representation from both academic years.

Data collection instrument

A comprehensive questionnaire was developed based on established frameworks for assessing diabetes education competencies and validated KAP assessment tools.[13,14] The instrument underwent content validation by three subject matter experts: one endocrinologist, one medical educator, and one public health specialist with expertise in diabetes care. The study questionnaire was structured into four sections. Section A captured demographic characteristics, including age, gender, academic year, prior diabetes-related training or experience, and personal interest in endocrinology or diabetes care. Section B assessed knowledge through 15 items covering diabetes pathophysiology and types, principles of self-management, educational strategies, prevention and monitoring of complications, and psychosocial aspects of diabetes care.

Section C evaluated attitudes using five items focusing on beliefs regarding the importance of patient education, confidence in educational abilities, perceived effectiveness of DSME, professional responsibility toward patient education, and interest in specializing in diabetes care. Section D examined practices through six items related to current patient education activities, use of educational resources, participation in diabetes care teams, application of learned principles in clinical settings, and engagement in professional development activities.

Scoring system

Each domain was scored using standardized criteria:

Knowledge domain: Multiple-choice and true/false questions (1 point per correct answer; maximum 15 points)

Attitude domain: 5-point Likert scale items (1=strongly disagree to 5=strongly agree; maximum 25 points)

Practice domain: Frequency-based responses (1=never to 4=always; maximum 24 points)

Scores were converted to percentages and categorized as:

Good: >70th percentile of the distribution

Poor: ≤70th percentile of the distribution

Data collection procedures

Data collection was conducted over a four-week period during regular academic sessions. Students were briefed about the study objectives and assured of confidentiality. Participation was voluntary, and no academic credit or penalties were associated with participation or performance. Questionnaires were administered during scheduled class periods under standardized conditions. Students were given 45 minutes to complete the assessment, with research assistants available to clarify procedural questions without providing content assistance.

Statistical analysis

Data analysis was performed using SPSS version 21.0. Descriptive statistics included means, standard deviations, frequencies, and percentages. Categorical variables were compared using chi-square tests, and continuous variables were analyzed using independent t-tests or ANOVA as appropriate. Correlation analyses examined relationships between KAP domains. Multiple regression analysis identified factors associated with higher scores in each domain. Statistical significance was set at $p<0.05$.

Ethical considerations

The study protocol received approval from the Institutional Ethics Committee. All participants provided written informed consent after receiving detailed information about the study objectives, procedures, and their rights as research participants. Data confidentiality was maintained through anonymous coding.

RESULTS

Participant characteristics

The study enrolled 200 medical students with a mean age of 23.2±1.1 years. Males comprised 55.5% (n=111) and females 44.5% (n=89) of the sample. Academic year distribution showed 51.5% (n=103) fourth-year and 48.5% (n=97) fifth-year students. Age distribution revealed 22.5% aged 22 years, 37.5% aged 23 years, 25.5% aged 24 years, and 14.5% aged >25 years.

The attitude domain in Table 1 showed the highest proportion of good scores (91%), followed by knowledge (74%) and practice (72%). Mean knowledge score was 6.51±1.39 out of a possible 15 points, attitude score was 3.17±0.83 out of 5 points, and practice score was 4.03±0.89 out of 6 points.

Demographic analysis of KAP scores

The 23-year age group represented in Table 2 shows the largest proportion of participants across all KAP domains. Notable findings included higher practice domain deficits among 24-year-old students and better overall

performance among students >25 years of age. Gender analysis in Table 3 revealed minimal differences across KAP domains. Males showed slightly higher absolute numbers in good knowledge category (84 vs 64), while the proportion of poor attitudes was similar between genders (9.0% males vs 9.0% females).In Table 4, Fourth-year students demonstrated better performance across all domains, with notably better attitude scores (93 good vs 89 for fifth-year) and practice scores (80 good vs 64 for fifth-year). This finding was unexpected, as senior students typically show improved clinical competencies.

Table 1: Overall knowledge, attitude, and practice score distribution.

Domain	Mean ± SD	Range	Poor N (%)	Good N (%)
Knowledge	6.51±1.39	3-12	52 (26%)	148 (74%)
Attitude	3.17±0.83	1-5	18 (9%)	182 (91%)
Practice	4.03±0.89	2-6	56 (28%)	144 (72%)

Table 2: KAP scores by age group.

Age group (years)	Knowledge poor/good (N)	Attitude poor/good (N)	Practice poor/good (N)
22	13/33	2/44	11/35
23	19/56	10/65	16/59
24	12/41	4/49	19/34
>25	8/18	2/24	10/16

Table 3: KAP scores by gender.

Gender	Knowledge poor/good (N)	Attitude poor/good (N)	Practice poor/good (N)
Male	27/84	10/101	28/83
Female	25/64	8/81	28/61

Table 4: KAP scores by academic year.

Academic year	Knowledge poor/good (N)	Attitude poor/good (N)	Practice poor/good (N)
4th year	25/78	11/93	23/80
5th year	27/70	7/89	33/64
Total	52/148	18/182	56/144

Domain-specific analysis

Knowledge domain performance: Common knowledge deficits included:

Limited understanding of specific DSME techniques (42% incorrect responses)

Inadequate knowledge of psychosocial aspects of diabetes care (38% incorrect)

Poor familiarity with community resources and support systems (45% incorrect)

Incomplete understanding of patient motivation and behavior change principles (51% incorrect)

Areas of strength included:

Basic diabetes pathophysiology (89% correct responses)

Recognition of major complications (85% correct)

Understanding of medication classes and mechanisms (78% correct)

Attitude domain performance: Positive findings included:

94% agreed that patient education is a physician's responsibility

91% believed DSME improves patient outcomes

87% expressed confidence in their ability to learn educational skills

Areas of concern

23% felt inadequately prepared to handle patient resistance to lifestyle changes

31% were uncertain about the effectiveness of group vs. individual education

28% lacked confidence in counseling patients from different cultural backgrounds

Practice domain performance: Current practice patterns showed:

68% regularly engaged patients in educational conversations during clinical encounters

45% used structured educational materials or resources

34% participated in multidisciplinary diabetes care team meetings

52% sought feedback on their educational effectiveness

Barriers to practice included:

Time constraints during clinical rotations

Limited access to educational resources

Lack of supervision and feedback on educational skills

Table 5: Correlations between KAP domains.

Variables	Correlation coefficient	P value
Knowledge-attitude	0.342	<0.001
Knowledge-practice	0.528	<0.001
Attitude-practice	0.287	<0.001

All KAP domains in Table 5 showed significant positive correlations.

The strongest correlation was observed between knowledge and practice (r=0.528), suggesting that students with better theoretical understanding were more likely to engage in educational practices.

Factors associated with higher performance

Multiple regression analysis identified several factors associated with higher KAP scores:

Knowledge domain

Previous participation in diabetes-related training (β=0.245, p<0.01)

Personal interest in endocrinology (β=0.198, p<0.05)

Academic year (4th year better than 5th year) (β=-0.167, p<0.05)

Attitude domain

Personal experience with diabetes patients (β=0.234, p<0.01)

Perceived importance of patient education (β=0.312, p<0.001)

Academic year (4th year better than 5th year) (β=-0.145, p<0.05)

Practice domain

Knowledge scores (β=0.467, p<0.001)

Clinical rotation experience (β=0.223, p<0.01)

Faculty mentorship availability (β=0.189, p<0.05)

DISCUSSION

Principal findings

This comprehensive assessment of medical students' knowledge, attitudes, and practices regarding DSMES revealed both encouraging findings and significant areas for improvement. While the majority of students demonstrated positive attitudes toward patient education (91% good scores) and adequate foundational knowledge (74% good scores), concerning gaps persist in practical application and advanced educational competencies.

Knowledge domain analysis

The knowledge assessment revealed a paradoxical pattern: students demonstrated strong performance in biomedical aspects of diabetes care but significant deficits in educational and behavioral domains. This finding aligns with previous research suggesting that traditional medical education effectively imparts pathophysiological knowledge but inadequately addresses the psychosocial and educational competencies essential for comprehensive diabetes care.[15,16] The observed knowledge gaps in patient motivation, behavior change principles, and community resources represent critical deficiencies that could significantly impact future clinical effectiveness. These areas are fundamental to successful DSME delivery, as diabetes management requires sustained behavioral changes that extend beyond medical intervention.[17]

Interestingly, fourth-year students outperformed fifth-year students across all domains, contrary to the expected progression of competency with advancing clinical experience. This finding may reflect several factors: fourth-year students may have more recent exposure to structured diabetes education content, fifth-year students may experience increased clinical pressures that reduce focus on educational competencies, or the current curriculum may inadequately reinforce educational skills during advanced clinical training.

Attitude domain strengths and challenges

The attitude domain showed the most encouraging results, with 91% of students demonstrating positive attitudes toward diabetes education. This finding is particularly important because attitudes serve as strong

predictors of future behavior and professional development.[18] Students' recognition of their professional responsibility for patient education and their belief in DSME effectiveness provide a solid foundation for competency development.

However, concerning attitudes emerged regarding cultural competency, patient resistance management, and educational methodology selection. These deficits may reflect insufficient exposure to diverse patient populations and limited training in advanced communication and counseling techniques. The globalization of healthcare and increasing diversity of patient populations make these competencies increasingly essential for effective clinical practice.[19]

Practice domain implementation gaps

The practice domain revealed the most significant challenges, with 28% of students showing poor engagement in educational activities. While the majority engaged patients in educational conversations, fewer utilized structured resources, participated in team-based care, or sought performance feedback. This pattern suggests that students may view education as informal dialogue rather than structured, evidence-based intervention.

The identified barriers—time constraints, limited resources, and inadequate supervision—reflect systemic issues within clinical education environments. These findings highlight the need for institutional support, dedicated educational resources, and faculty development to create environments conducive to educational skill development.[20]

Correlational findings and implications

The significant positive correlations between all KAP domains support the theoretical framework underlying competency-based medical education. The particularly strong knowledge-practice correlation (r=0.528) suggests that theoretical understanding serves as a foundation for practical application, emphasizing the importance of comprehensive knowledge development as a prerequisite for effective practice.

These correlations also indicate that interventions targeting one domain may have spillover effects on others, suggesting that comprehensive educational programs addressing multiple domains simultaneously may be more effective than isolated knowledge or skills training.

Demographic and academic factors

The minimal gender differences across KAP domains suggest that both male and female students are equally prepared for diabetes education roles, contradicting some previous research suggesting gender-based differences in communication and counseling preferences.[21] This finding supports gender-neutral approaches to diabetes education training.

The age distribution analysis revealed better performance among older students (>25 years), which may reflect increased maturity, life experience, or different educational backgrounds prior to medical school. This finding suggests that diverse student backgrounds may be assets in developing comprehensive educational competencies.

Implications for medical education

These findings have several important implications for medical education curriculum development:

Curriculum integration: The knowledge gaps in educational methodology and behavioral science suggest the need for enhanced integration of these topics throughout medical education, rather than relegating them to elective or specialized courses.

Clinical training enhancement: The practice domain deficits indicate that clinical rotations should include structured educational experiences with dedicated supervision and feedback on educational skills development.

Faculty development: The identified barriers suggest that clinical faculty may themselves need training in diabetes education principles and supervision techniques to effectively mentor students in these competencies.

Resource development: The limited use of structured educational resources highlights the need for accessible, evidence-based educational materials and training in their effective utilization.

Assessment integration: The positive attitudes but limited practice suggest that current assessment methods may inadequately evaluate educational competencies, potentially sending mixed messages about their importance.

International context and comparisons

Comparing these findings with international studies reveals both universal challenges and context-specific issues. Similar knowledge-practice gaps have been reported in medical education systems worldwide, suggesting that this is a widespread challenge rather than a localized problem.[22,23] However, the specific patterns of deficits may reflect cultural, healthcare system, and educational approach differences that require tailored interventions.

The relatively positive attitudes observed in this study contrast with some international reports suggesting medical student cynicism about patient education

effectiveness.[24] This difference may reflect cultural values emphasizing physician responsibility for patient welfare or different healthcare system expectations.

CONCLUSION

This study provides the first comprehensive assessment of medical students' knowledge, attitudes, and practices regarding DSMES in the Indian medical education context. The findings reveal a mixed picture: while students demonstrate positive attitudes toward patient education and adequate foundational diabetes knowledge, significant gaps persist in advanced educational competencies and practical application.

The knowledge-practice gap identified in this study mirrors broader challenges in medical education where theoretical learning often fails to translate into effective clinical practice. The particularly concerning deficits in psychosocial aspects of care, patient motivation, and behavior change principles represent critical areas requiring immediate curricular attention.

Recommendations

Based on the study findings, several recommendations are proposed. Immediate curricular actions include integrating structured DSME training modules into core clinical courses, developing standardized patient encounters focused on diabetes education, creating assessment methods to evaluate educational competencies, and establishing partnerships with diabetes education programs to enhance clinical exposure.

At the faculty and institutional level, efforts should focus on providing faculty training in diabetes education principles and supervision, developing institutional resources to support student-led educational activities, allocating protected time for educational skill development during clinical rotations, and establishing quality improvement processes to strengthen educational competency development. From a research and evaluation perspective, future work should include longitudinal studies to track competency development over time, controlled trials to evaluate the effectiveness of educational interventions, assessment of patient outcomes in relation to varying levels of provider educational competency, and the development and validation of comprehensive instruments to assess educational competencies.

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